AbstractID: 12990 Title: The X's and O's of 3D Dosimetry Phantoms

Purpose: As rotational radiation therapy becomes more prevalent, the need grows for new methodologies of per-patient dose QA. An approach commonly used for static-field IMRT QA (per-beam planar dose normal to the beam axis) is less relevant for rotating beams; thus, more attention has turned to composite dose in a 3D phantom. In this work, two commercial 3D dosimetry phantoms are studied under identical conditions (TPS, delivery) for rotational plans.

Materials and Methods: The Delta4 (ScandiDos) and ArcCHECK (Sun Nuclear Corporation) devices were each entered into the TPS as QA phantoms for the transference of VMAT plans produced by the Pinnacle TPS (Philips). The sensitivity to the angular discretizing of a rotational plan into 2, 4, and 6 degree sub-arcs was studied. In addition, small errors were introduced into the TPS calculation (MLC shifts, transmission changes) to assay each device's sensitivity to those errors.

Results: The ArcCHECK's peripheral detector geometry was far more sensitive to TPS angular discretization of the dose calculation; however, the impact of the difference in 2-degree and 4-degree sub-arcs was very small in the high dose central/target regions, as evidenced by the high passing rates of the Delta4. Both devices showed insensitivity to small errors induced in MLC position and transmission, but both were sensitive (D4 at 3%/3mm and 2%/2mm, AC at 2%/2mm) to MLC shifts of 0.9 mm. Comparison results between Delta4 and ArcCHECK trended similarly, but passing rates were not the same.

Conclusions: The design of the detectors' locations in 3D space is critical to understanding the behavior of a 3D dosimetry phantom. Dose QA results measured by one system are not interchangeable with another's if the detector geometries are not identical. Ideally, it would be useful to correlate these phantom dose QA results to their impact to patient dose/DVH on a per-patient basis.